

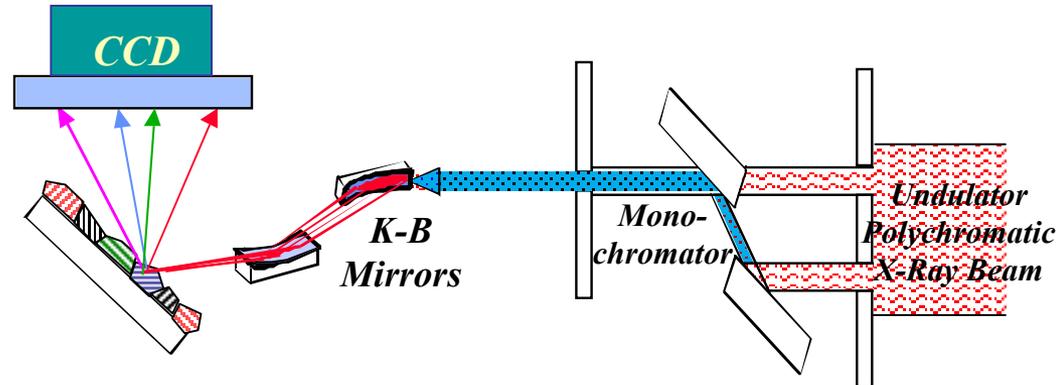
X-ray Microbeam Studies of Thermal Strains in Thin Films

G. S. Cargill III, DMR-0312189

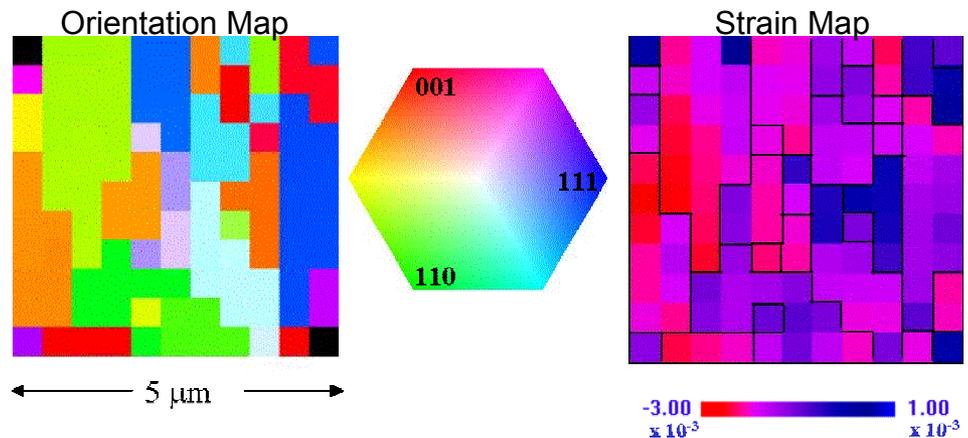
X-ray diffraction has long been used to measure elastic strains in polycrystalline materials averaged over millimeter size areas and many differently oriented grains. Synchrotron x-ray sources and microbeam focusing optics now allow orientation and strain measurements to be made over micron size areas on a grain-by-grain basis.

Understanding local grain orientation and strain behavior provides a critical link between microscopic and macroscopic properties of polycrystalline solids, including aluminum thin films used in microelectronic devices.

G. S. Cargill III, L. Moyer, W. Yang, B. C. Larson, and G. E. Ice, "X-ray Microbeam Strain Measurements in Polycrystalline Films," *Mat. Sci. Forum* **426-432**, 3945-3950 (2003).



Microbeam x-ray diffraction experiment at Advanced Photon Source (from B. C. Larson et al., UNICAT and ORNL).



Grain orientation and strain maps from $2 \mu\text{m}$ -thick Al film. The hexagon shows colors used to represent different orientations.

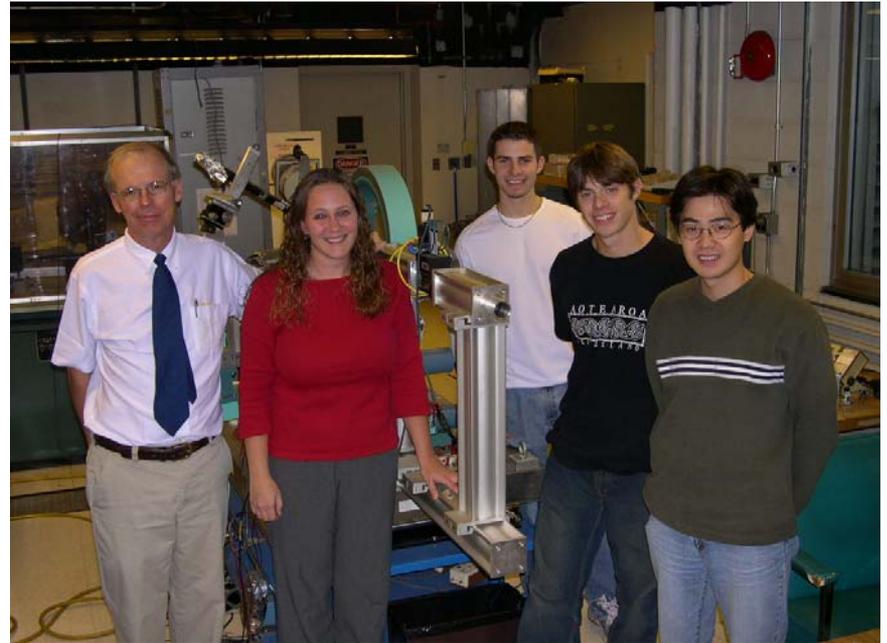
X-ray Microbeam Studies of Thermal Strains in Thin Films

G. S. Cargill III, DMR-0312189

Broader Impacts:

Two graduate students, Laura Moyer and Gan Wang, are contributing to this project. Ms. Moyer's M.S. thesis was on x-ray measurements of strain in thin copper films, and her Ph.D. dissertation is on x-ray microbeam strain measurements. For the last three summers she has also worked with Dr. B. C. Larson at UNICAT/APS. Mr. Wang is beginning graduate research on x-ray microdiffraction.

Two undergraduates, Adam Eyth and Matt Kampner, also worked on this project for ten weeks during summer 2003. Mr. Kampner spent half of this time with Dr. C.-K. Hu at IBM Research.



Dr. G. S. Cargill III (far left) along with Lehigh graduate and undergraduate students (from left) Laura Moyer, Adam Eyth, and Matt Kampner, and Gan Wang, with microbeam diffraction instrument.